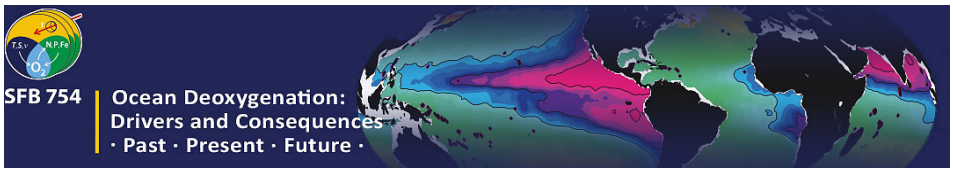

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El Niño influence on Peruvian shelf trace metal supply to the ocean

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Shelf sediments in oxygen minimum zones (OMZs) are a major contributor of iron (Fe) and other bioessential trace metals to offshore waters. Future changes in metal fluxes are projected as a result of expansion of OMZs, potentially having important biogeochemical impacts on adjacent ocean systems. Resolving the processes in OMZs that determine trace metal release from sediments, stabilisation preventing loss by scavenging and precipitation, and offshelf transport is thus essential. To this end we measured a suite of bioessential (e.g. Fe, Co, Cu, Zn) and process-diagnostic (e.g. sediment release- Mn; scavenging- Pb) dissolved and total-dissolvable trace metals alongside coupled Fe(III)-Fe(II) measurements to evaluate trace metal release, stabilisation, and offshelf transport in the Peruvian OMZ.
We observed high Fe(II), dissolved Fe, and total-dissolvable Fe close to the shelf with concentrations rapidly decreasing further offshore within anoxic waters, suggesting progressive oxidation by non-oxygen electron acceptors followed by subsequent precipitation/scavenging. Offshore, maxima in leachable Fe concentrations (total dissolvable Fe minus dissolved Fe) were always present in the upper OMZ (up to 16 nM), indicating the particulate Fe pool probably dominates offshore Fe transport. The cruise was conducted in Oct 2015 during a developing El Niño event, with atypical upwelling of oxygen-rich water in the North Peruvian Shelf, whereas upwelling of oxygen-depleted water was still occurring over the South Peruvian Shelf. Despite a narrower shelf width, enhanced Fe concentrations persisted offshore over the South Peruvian shelf relative to the North, therefore suggesting a strong impact of El Niño conditions on the regional strengths of offshore Fe transport.

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